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The project was to exploit properties of high molecular weight polymeric solutions for applications to cleanup of contaminated solid and liquid (oil slick) surfaces. Experiments of Wang and Joseph 2003 showed that the addition of small solid particles to these solutions can greatly enhance the cleanup properties. The research focused on applications, defining application areas and the operating conditions for good cleanup, and on theoretical issues directed at understanding the extensional properties of high molecular weight polymeric solution especially when they are laden with small particles. In the course of the research we found a new material, PEO laden with silicananoparticles

J. Wang, R. Bai, and D.D. Joseph, 2004. Nanoparticle laden tubeless and open siphons. J. Fluid Mech., submitted.

Tubeless and open siphons are unusual types of siphons which operate without conduits, in the open, supported only by extensional stresses. Here, we demonstrate that the addition of silica nanoparticles in modest concentrations (of the order of 1% by weight) to a moderately dilute aqueous Poly(ethylene oxide) (PEO) solution (0.5% by weight) has a dramatic affect on the life and power of the siphon as well as on the ability of the siphon to clean substrates clean of liquid. These kinds of dramatic effects may have a partly fluid mechanical explanation, since they also occur when the siphon is laden with inert sub-millimeter particles (Wang and Joseph 2003 [**Error! Reference source not found.**]). The extensional properties of PEO solutions are greatly enhanced and the degredation of the solutions is much slower when the PEO solutions are loaded with silica nanoparticles.

This STIR grant was preliminary for proof of concept. In our future work we will look at further fundamentals and direct efforts to build sucking devices to pull off contaminants.

Respectfully submitted, Daniel D. Joseph